Microsoft

Operating System

Support and Management Improvements

Abstract

This paper is for information technology (IT) professionals responsible for the support and management of desktop systems. It provides an overview of key support and management capabilities in the Microsoft® Windows® 2000 Professional operating system.

This document is based on features in the Beta 3 version of Windows 2000 Professional (April 1999). Readers should be aware that features in the final released version of Windows 2000 Professional might vary.

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INTRODUCTION

Today, businesses invest a great deal of time and resources keeping desktop PCs up and running so users remain productive. The Microsoft® Windows® 2000 Professional operating system is designed to significantly reduce support and management costs providing a stable desktop environment for users.

Windows 2000 Professional provides the following improvements.

- Reduces the number of support calls by making applications and hardware more reliable.
- Provides a more dependable method for installing.
- Reduces the time it takes to diagnose and correct problems.
- Provides enhanced support for management software.

REDUCING SUPPORT INCIDENTS

Windows 2000 Professional lightens the support and management burden by reducing the number of support calls by making applications and hardware more reliable and reducing what the Gartner Group calls the end user "futz" factor. Key capabilities include a more dependable method for installing applications; guidelines for application developers for creating more reliable and resilient applications; and increased protection against dynamic-link library (DLL) conflicts. For hardware reliability, Windows 2000 Professional includes support for the next generation of Plug and Play, power management, and code signing and verification. Wizards guide users through features and self-help mechanisms, such as sophisticated troubleshooters make users more self-reliant. Deployment methods are more comprehensive and ensure that all configurations are completed properly.

Windows Installer-Based Applications

One of the most common support calls is for applications that stop working properly. In many cases, application errors are due to missing or corrupt files. The most effective way to resolve this type of problem is to completely reinstall the affected application – in the best case scenario this would happen before a technician has spent time attempting to diagnose and correct the problem.

Microsoft is working with independent software vendors (ISVs) to introduce a, more reliable application-installation technology, called *Windows Installer*. This service defines and enforces a standard format for application setup and tracks components such as groups of files, registry entries, shortcuts, and other aspects of the application that must be managed together. This provides for:

- **Self-repairing applications**. If a key file is missing, the Windows Installer performs an on-demand installation of the missing file. The Windows Installer has the ability to look for backup sources if the original source is unavailable due to network outage or other temporary problem. At the time of deployment, administrators have the ability to provide the Windows Installer service with a list of backup source locations for that particular product. In addition, if the Windows Installer service cannot find any available source from the list provided, it can prompt the user to browse for a source, and it will then add any *browsed* sources to the existing list for that product.
- **Reduces DLL conflicts**. A Windows Installer package allows the administrator to easily determine what files, and what versions of those files, are being installed. This is especially beneficial for corporations that maintain a list of known good versions of shared DLLs and allow installation of applications that require a shared DLL only on the basis of that list.
- **Rollback failed installations**. If an installation fails, Windows Installer detects the point of failure and removes changes made up to that point.
- **Removing applications**. When applications are removed, Windows Installer uninstalls the application and can restore all components, including registry entries.

Refined Application Specification

To help make applications more reliable, Microsoft developed, in cooperation with customers and software developers, the Windows 2000 Application Specification (available from, http://msdn.microsoft.com/winlogo.) It provides clear, concise guidelines to help developers create more predictable and reliable applications. The specification focuses on several core areas:

- **Install/Uninstall Requirements**. Install and uninstall issues are one of the most common sources of application co-existence problems. These requirements help ensure that the user has successful install and uninstall experiences, and that the application inter-operates in the correct manner with other applications on the machine. The Windows Installer service helps the operating system manage application setup and configuration, including the following:
    - Management of refcounting and version checking of shared components helps ensure that applications better inter-operate with one another.
    - Reliable and complete uninstall, including correct handling of shared components.
    - Ability to perform installation on secure systems (for non-administrators and non-power users).
    - Applications can use the functionality of the Windows 2000 IntelliMirror™ management technologies for policy-based deployment, update, and uninstallation over a network.
- **User and Computer Settings Management Requirements**. Windows 2000 Professional provides an underlying infrastructure to install, configure, and manage applications. These requirements provide guidelines for software developers on how to write applications that make use of this infrastructure, and thereby reduce the overall TCO for customers. Administrators can define computing environments for groups of users and computers that are automatically deployed. Settings that can be controlled include desktop settings, scripts for log on/log off, software installation options, and security settings. Furthermore, with the IntelliMirror feature enabled, administrators can restore a user's settings if their computer fails, and ensure that a user's desktop settings follow them when roaming to another computer. For applications to work properly in such an environment, it is critical that they take advantage of the Windows infrastructure by storing their data correctly, and complying with the administrator's pre-configured settings.
- **Requirements for user interface (UI) fundamentals**. Meeting UI requirements permits the use of sophisticated automation tools, including testing tools, task automation tools such as intelligent agents, and new input methods such as voice input. Organizations that use the Windows platforms require software to be usable by a wide range of users. Meeting these requires also helps to ensure that software will be compatible with future enhancements that are planned for the Windows platform, including speech input, speech output, and intelligent task automation.

- **OnNow Requirements**. The OnNow initiative is a set of design specifications which, when applied to system hardware and software applications, enable a PC to deliver the same instant on capabilities now available in consumer devices such as TVs, VCRs, and. Applications must participate in system-wide power management decision-making to ensure error-free handling of power down and power up scenarios. Applications must be able to put themselves to sleep on system or user request to support a low-power state, and then they must respond to wake notifications, preserving data appropriately.
- **Migration Requirements**. The goal of this requirement is to ensure that when users upgrade their operating system, previously installed applications will continue to function as before, with all preferences and privileges working after the upgrade.

Side-By-Side Components

One of the most common causes of application failure is when several application need access to slightly different versions of a DLL with the same name. For example, a line of business application was designed with particular versions of key DLLs in mind. Typically, these DLLs would have been installed in the system directory where they might be upgraded by another application. This often causes the original application to fail or not perform as expected.

Windows 2000 Professional includes several kernel level changes that make it possible for applications to place their specific versions of dependent DLLs into their own directories instead of in a globally shared location. When an application is opened, the version of the DLL the application was designed and tested with is run.

These changes serve two different types of customers. Software developers can produce components which are side-by-side *aware* so that developers who rely on the components can install them into their application directory. Also, corporate administrators can repackage existing applications so that dependent components are installed into the application directory instead of a shared directory.

System File Protection

In addition to enabling side-by-side components, Windows 2000 Professional provides another mechanism for reducing conflicts because of mismatching DLLs.

In Windows 2000 Professional, a feature called System File Protection (SFP) prevents the replacement of certain monitored system files.[1] P By preventing the replacement of essential system files, file version mismatches can be avoided..

SFP works as a background process that prevents replacement of essential system files such as the .sys, .dll, .ocx, .fon and .exe files that ship as part of Windows 2000 Professional. SFP protects system files by detecting when a protected system file is replaced. SFP will look up the file signature in a catalog file to determine if the new file is the correct Microsoft version. If it is not, the system either replaces the file

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[1] Administrators have the option of not enforcing System File Protection.

from the dllcache directory or distribution media, depending on whether or not the file is located in dllcache. By default, SFP will present a dialog box informing the administrative user that a system file has been restored to the original version. If an administrative user is not logged onto the system, SFP will wait until the next administrative user logs onto the box before presenting the error dialogs.

Replacement of protected system files will only be supported if installed by one of the following mechanisms:

- Windows 2000 Service Pack Installation (Update.exe)
- Hotfix Distributions (Hotfix.exe)
- Operating System upgrade (Winnt32.exe)
- Windows Update (Windows Update Icon)

Hardware Reliability

Windows 2000 Professional includes enhancements to simplify device driver development and device management. These enhancements include support for power management, Plug and Play, and low-level hardware instrumentation.

Plug and Play is a combination of hardware and software support that enables a computer system to recognize and adapt to hardware configuration changes with little or no user intervention. With Plug and Play, a user can add or remove devices dynamically, without awkward and confusing manual configuration and without any intricate knowledge of computer hardware.

For example, a user can dock a portable computer and use the docking station's Ethernet card to connect to the network without changing the configuration. Later, the user can undock that same computer and use a modem to connect to the network—again without making any manual configuration changes.

Plug and Play allows a user to change a computer's configuration with the assurance that all devices will work together and that the machine will boot correctly after the changes are made.

Advanced Configuration and Power Interface (ACPI)

Windows 2000 Professional supports the next generation of power management and Plug and Play, called Advanced Configuration and Power Interface (ACPI). ACPI provides a more robust solution than previous systems because the operating system, rather than a separate BIOS, controls both power management *and* Plug and Play functionality. The following features can help reduce calls to helpdesk:

- **Automatic and dynamic recognition of installed hardware**. Includes initial system installation, recognition of Plug and Play changes between system boots, and response to run-time hardware events such as dock and undock.
- **Hardware resource allocation (and reallocation)**. Required device resources are identified when the device is enumerated by the operating system. The Plug and Play Manager retrieves the requirements for each device during

resource allocation. Based on the resource requests, each device makes the Plug and Play Manager assign the appropriate hardware resources such as I/O ports, IRQs, and memory locations. The Plug and Play Manager reconfigures resource assignments when needed.

- **Loading appropriate drivers**. The Plug and Play Manager determines which drivers are required to support a particular device and loads those drivers.
- **Driver interaction with the Plug and Play system**. The interface consists of primarily I/O routines, Plug and Play I/O request packets, required driver entry points, and information in the registry to awaken a device or put it to sleep.
- **Registration for device notification events**. Plug and Play enables user-mode code to be notified of certain Plug and Play events.

Code Signing

To assure users that they are using the highest quality drivers, Microsoft will digitally sign drivers that pass the Windows Hardware Quality Lab (WHQL) tests. This digital signature will be associated with individual driver packages and will be recognized natively by Windows 2000 Professional. Devices covered include:

- Keyboard
- Hard Disk Controller
- Multimedia
- Monitor
- Modem
- Mouse
- Network cards
- Printer
- SCSI Adapter
- Smart Card Reader

Windows 2000 Professional supports the ability to either warn or entirely block users from installing unsigned code. If a file has not been digitally signed and resides in the above-referenced classes, a pop-up message will alert users that a file has not been digitally signed, and ask them if they would like to continue.

Driver signing uses the existing digital-signature cryptographic technology. A hash of the driver binary and relevant information are stored in a catalog file (.cat file), and the .cat file is signed with the Microsoft signature. The driver binary itself is not touched; only a .cat file is created for each driver package. The relationship between the driver package and its .cat file is referenced in the driver's .inf file and maintained by the system after the driver is installed.

Eliminating User Errors

Windows 2000 Professional provides users with tools to help eliminate errors such as Wizards to simplify routine tasks and improved Help resources so they can find answers to questions before errors occur. Additionally, error messages have been improved, reducing their complexity and number.

Task Wizards

Windows 2000 Professional includes many Wizards that provide users with step-by-step guidance on how to use various features. For example:

- **Network Connection Wizard**. Single location for creating different types of networking connections. Guides users through creating dial-up, virtual private network, computer-to-computer and other types of connections.
- **Add/Remove Hardware**. Guides users through adding or troubleshooting devices, as well as installing and uninstalling. Automatically scans the system for any configuration changes.
- **Offline Folders**. Gives users the ability to take network resources offline. The first time **Offline Folders** are used, the Wizard guides users through the process of understanding the features and how to use them.
- **Mapping network drives**. Guides users through the process of setting connections to file shares on the network.
- **Users and passwords**. Guides users through setting up new users and access rights on the computer.

Self-Help

Windows 2000 Professional provides more intelligent tools so users can attempt to correct problems themselves without causing more damage to a system. For example:

- **Troubleshooters**. Using advanced logic tools (Bayesian inference-based), users can describe an issue in non-technical language, and Windows 2000 Professional will provide a list of possible topics. Windows 2000 Professional Troubleshooters include:
    - Blue Screen
    - Client Services for Netware
    - DHCP
    - Dial-up Network Connections
    - Directory Services
    - DirectX
    - Display
    - Domain Name Service
    - General Hardware
    - Group Policy
    - Infrared
    - Internet Connections
    - Joystick
    - Keyboard
    - Modem
    - Mouse
    - MS-DOS Programs
    - Multimedia (including games)
    - Network Administration

- Networking (TCP/IP)
- PC Cards
- Printer
- Remote Access Server (RAS)
- Resource Conflicts
- Sound
- Startup/Shutdown
- System Setup
- Windows 3.x Programs
- WINS

- **Enhanced Help**. The Help system in Windows 2000 Professional has been enhanced and expanded in many ways. Based on feedback from Microsoft customers and support groups worldwide, Help coverage is now more thorough and includes:
  - Improved consistency in terminology, style and organization
  - More integrated troubleshooters
  - Streamlined Contents tab
  - Fewer levels
  - Increased emphasis on commonly used tasks
  - Common Task Lists for areas with more than 12-15 procedures
  - More shortcuts for starting components from Help
  - Extensive use of Related Topics links (hyperlinks)
  - Larger, more thorough index
  - A Web version of online Help and the Getting Started book

- **Balloon Help**. Windows 2000 Professional includes a new feature called Balloon Help. Similar to tool tips, the descriptions that appear by hovering the cursor over an icon, Balloon Help goes further by giving users additional helpful information. For example, the first time Personalized Menus appear, a Balloon Help dialog tells users what to expect. Balloon Help has been placed throughout the system to ensure users can more easily discover many of the usability enhancements in Windows 2000 Professional.

Refined System Messages

Windows 2000 Professional system messages, such as error messages, have been modified to be more helpful to the average user. Where possible, error messages give users specific actions to take, rather than just informing them that something went wrong. Messages also list related tools and Help topics that may prevent the error from happening again. Many true error messages that require user interaction and impact system stability are distinguished from informational messages. Many informational messages, if they don't impact the stability of the system, will automatically timeout and in some cases have been eliminated.

Enhanced Deployment

Windows 2000 Professional supports enhanced deployment in the enterprise by giving administrators a variety of tools to automate installation. The process of upgrading from an earlier version of the Windows operating system or applying a service pack has also been streamlined.

Automated Installation Enhancements

By creating automated installation scripts, administrators can eliminate the need to visit the desktop and prevent users from having to answer questions. Traditionally, scripts have been difficult to create and required extensive research and troubleshooting to work properly. Even the most skilled script writers often could not fully automate every aspect of setup because not all setup functionality could be easily scripted. For example, installing sound cards could not be scripted.

Windows 2000 Professional includes support for automated installation scripts, including:

- **Nearly every aspect of installation can be scripted**. Windows 2000 Professional supports keys make it possible to easily script a complete installation, including modems, sound cards, time zones and other areas traditionally difficult to script. Windows 2000 Professional supports several new tools that make it easier for administrators to make systems unique, such as setting static IP addresses or using a list of machine names.[2]
- **Installation can be completed with no user interaction**. Previously it was difficult to completely hide installation options from users—such as, the product ID page—every aspect of Windows 2000 Professional can be installed without user interaction.
- **Easier to create scripts**. Using a new graphical tool, called Setup Manager, administrators can more easily create installation scripts. Setup Manager takes care of many traditionally challenging tasks, such as using correct syntax, and eliminates typographical errors, which are often the cause when scripts do not work properly. Setup Manager also includes the ability to create or import UDF files, which are files used to apply unique settings to desktops, such as machine names and static IP addresses.
- **Scripts are more reliable**. The setup process has been improved so that it does not stop installation if a non-critical device (for example, a modem) does not install properly. Windows 2000 Professional also supports better reporting mechanisms so administrators can troubleshoot installations that did not go as planned.

Support for Disk Imaging

Disk imaging, often referred to as "cloning," is the process of creating a master image, preparing that image for duplication using the Microsoft System Preparation Tool, then duplicating that image across multiple systems using a copying utility such as Norton Ghost from Symantec or PowerQuest DriveImage. Because the

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[2] The full list of scriptable parameters can be found on www.microsoft.com/windows.

master image includes the operating system, applications and customizations, any system that uses that image will be fully functioning at first logon.[3]

Disk imaging is a very fast method for deploying new systems and has consequently become a favored method for deployment. However, disk imaging has also had several limitations. First, a master image works only on identical (or very nearly identical systems). This means that an administrator cannot generally use the same image even if the computers come from the same manufacturer. Second, disk imaging processes today do not do a good job of integrating even typical post-installation tasks, such as adding a computer to a domain. Finally, because disk imaging overwrites all of the existing files on a PC, unless administrators take efforts to save user data, disk imaging is appropriate for new systems only.

Disk imaging support in Windows 2000 Professional and specifically the System Preparation Utility have been designed to address these limitations. For example:

- **Images can be used on a wider variety of hardware**. Because Windows 2000 Professional supports hardware detection and Plug and Play, images can be used on systems with different modems, display adapters and other non-boot-critical hardware.[4]
- **Post-installation tasks are now integrated**. Automated installation scripts are now an integrated part of preparing a system. Administrators can now perform the vast majority of functions available with Setup Manager, such as adding machine names from a predetermined list, joining the computer to an existing domain and adding additional settings and components as part of deployment.

Remote Installation Services

Remote Operating System (OS) Installation and IntelliMirror are important change and configuration management features included with Windows 2000 Professional and Windows 2000 Server. Remote OS Installation allows systems administrators to use the Pre-Boot eXecution Environment (PXE)-based remote-boot technology and server-based distribution software to install local copies of Windows 2000 Professional on personal computers throughout the enterprise. Once Windows 2000 Professional is operational on a PC, IntelliMirror then is used by network administrators to provide policy-based management of users' Windows 2000 Professional–based desktops, including data, settings, and application software.

New desktop computers connect to a Windows 2000 Server during initial boot up, and then the server drives a local installation of Windows 2000 Professional. This significantly simplifies the task of installing the client operating system throughout an organization.

Remote OS Installation uses the PXE Dynamic Host Configuration Protocol (DHCP)–based remote boot technology to initiate the installation of an operating

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[3] For more information on how disk imaging works, please visit www.microsoft.com/ntworkstation.

[4] For using images on systems with different boot-critical hardware, see the Remote Installation Services section of this document.

system from a remote source to a client computer's local hard disk. The remote source—a server that supports the Remote Installation Services (RIS)—provides the network equivalent of a CD-based installation of Windows 2000 Professional or a pre-configured Remote Installation Preparation (RIPrep) desktop image.[5]

Upgrade Paths

Windows 2000 Professional has been designed to be the operating system for users in businesses of any size. Companies can upgrade to Windows 2000 Professional from any of the following operating systems:

- Windows NT® Workstation 4.0 or Windows NT Workstation 3.51
- Windows 98 or Windows 95

The upgrade process for each of the operating systems can be automated and in most cases will run smoothly. In addition, administrators can use automated installation scripts to augment the upgrade, such as to add drivers that are not part of the standard Windows 2000 Professional installation.

Services Pack Slipstreaming

In the past, administrators were required to apply service packs after a clean installation of the operating system and after adding any applications to a machine. Windows 2000 provides features to integrate service packs with the operating system, so network administrators do not need to reapply a service pack after making changes in the system state. This offers companies significant time savings and lowers the barrier to upgrading systems and adding new applications. Windows 2000 Professional also offers significant enhancements for deploying services packs in a corporate environment.

Windows 2000 Professional detects when a service pack has been applied and detects which files and DLLs were affected. As a result, the operating system knows that some files may need to be applied from the service pack or from the original media. This eliminates the need to constantly reapply service packs when the system state changes. Service packs can also be applied to shares of Windows 2000 for clean installs in a process called *slipstreaming*.

Windows 2000 Professional makes it significantly easier for administrators to add service packs. Previously service packs had to be installed separately from the operating system installation, Windows 2000 Professional supports service pack slipstreaming, the ability to add the service pack directly to the Windows 2000 Professional distribution share. With slipstreaming, users experience a single install.

Windows 2000 Professional also eliminates the need to reinstall components that were applied before a service pack was installed, making it easier to install service packs on existing systems. Before, when service packs were applied, many previously installed components needed to be reinstalled. In addition, services or

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[5] Currently, the Windows 2000 Server RIS feature supports installation of the Windows 2000 Professional operating system on client computers only.

components installed after installing the service pack will not require reinstalling the service pack. Today, in some cases administrators are required to reinstall service packs after installing new components because the installation can only install files from the original distribution media. With Windows 2000 Professional, new components are able to draw files from both the original distribution media *and* the service pack files.

Windows 2000 Professional was designed to reduce the time it takes to diagnose and correct problems. The Microsoft System information Utility provides a one-stop location for support professionals to troubleshoot problems. The Windows 2000 Professional Resource Kit utilities provide administrators with powerful diagnostic tools. Further information regarding the Resource Kit is available from www.microsoft.com. Diagnostic Booting options make it possible to boot in *Safe Mode*, including booting to a command console. The Windows Update Web resource provides administrators with a frequently updated database of drivers. The Microsoft Management Console (MMC) provides an extensive framework for management applications. New scripting capabilities and the Windows Scripting Host make it easier for administrators to correct problems. Support for industry standards, such as Web-Based Enterprise Management (WBEM), makes Windows 2000 Professional easier to support in almost any environment.

Easier Problem Identification and Resolution

Windows 2000 Professional supports the tools that can help the administrator identify problems with the users system. Some of these tools ship as part of the product and some are available in the Windows 2000 Professional Resource Kit.

System Information Snap-in

Windows 2000 Professional provides an enhanced tool to help support personnel diagnose and correct problems.[6] Called the Microsoft System Information Utility, this utility collects and displays configuration information. The System Information tool is used to quickly find the required data to resolve problems, including information about hardware, system components, and the software environment. More specifically, the utility can be used to gather information about the following.

- **Hardware Resources** displays hardware resource settings such as DMA, IRQs, I/O addresses and memory addresses. A Conflicts Sharing section identifies devices that are sharing resources or are in conflict. This can help identify problems with a device.
- **Components** displays information about the Windows configuration and is used to determine the status of device drivers, networking and multimedia software.
- **Software Environment** displays a snapshot of the software loaded into computer memory. This information can be used to see if a process is still running or to check version information.

The System Information utility also provides access to several key support tools:

- Disk Cleanup
- Dr. Watson
- Network Connections
- Add/Remove Hardware Wizard

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[6] This tool is not exposed to end users. To access the tool, type MSINFO32 from the Run command.

- Backup Utility
- Scan Disk
- File Signature Verification Utility. Verifies that critical files have Microsoft digital signature.
- Windows Report Tool

Resource Kit Tools

The Windows 2000 Professional Resource Kit includes critical support tools that can help isolate, diagnose, and in some cases repair problems. The content is targeted at common support issues. Tools available in the Resource Kit include:

- **AdsiEdit** is a Microsoft Management Console (MMC) snap-in that acts as a low-level editor for the Active Directory™ directory services. Through the Active Directory Services Interfaces, it provides a means to add, delete, and move objects within the Directory Services. The attributes of each object can be viewed, changed, and deleted.
- **Browstat** is a general purpose, character-based browser diagnostic tool. Use Browstat to find out whether a browser is running and to find active Microsoft Windows for Workgroups browsers in Windows NT–based domains. This utility also provides information about the state of the browser in a workgroup, including the name of the master browser.
- **Ldp** is a graphical tool that allows users to perform Lightweight Directory Access Protocol (LDAP) operations, such as connect, bind, search, modify, add, and delete, against any LDAP-compatible directory, such as the Active Directory. LDAP is an Internet-standard wire protocol used by the Active Directory.
- **Netdiag** is a command-line diagnostic tool that helps isolate networking and connectivity problems by performing a series of tests to determine the state of your network client and whether it is functional. These tests and the key network status information they expose give network administrators and support personnel a more direct means of identifying and isolating network problems. Moreover, because this tool does not require that parameters or switches be specified, support personnel and network administrators can focus on analyzing the output, rather than training users on tool usage.
- **Dxdiag** is a tool that presents information about the components and drivers of the Microsoft® DirectX® API installed on your system. Administrators or users can use it to test sound and graphics output and disable some hardware acceleration features. Users can use DirectX Diagnostic Tool to gather information for a technician during a support call or to send information gathered by the tool by pasting it into an e-mail message.
- **Nltest** is a command-line tool that helps perform administrative tasks such as forcing a user-account database into sync, getting a list of primary domain controllers, forcing a shutdown, and querying and checking on the status of trust.
- **Dskprobe** is a sector editor for Windows 2000 Professional. It allows a user

with local Administrator rights to directly edit, save and copy data on the physical hard drive that is not accessible in any other way. DiskProbe is used to replace the Master Boot Record, repair damaged partition table information and to repair or replace damaged Partition Boot Sectors or other file system data. The program can also save Master Boot Records and Partition Boot Sectors as files. They can then be replaced if the sectors become damaged at a later time. These on-disk data structures are not accessible through the file system, and so are not saved by any backup programs currently available.

- **Pptpclnt and Pptpsrv.exe** are utilities that work in unison to verify that the required protocol and port for Point-to-Point Tunneling Protocol (PPTP) is being routed from a PPTP client to a PPTP server or vice-versa. Note: This utility is not meant to test the functionality of a PPTP server or a PPTP client.
- **Memsnap** is a memory profiling tool that takes a snapshot of the memory resources being consumed by all running processes and writes this information to a log file.

Diagnostic booting options

For systems that will not start properly, Windows 2000 Professional supports a safe-mode options screen that will be accessible from the initial boot loader by pressing the F8 key. The safe-mode options are:

- **Safe Mode**. This option will load the basic devices and drivers to start the system: mouse, keyboard, Mass Storage, base video, and the standard default set of system services.
- **Safe Mode with Networking**. This option would load all of the above, plus the essential services and drivers needed to start networking
- **Safe Mode with Command Prompt**. This is exactly the same as safe mode, with the exception that a command prompt is launched rather than Windows Explorer.
- **Last-known Good Configuration**: This option would let the user use the last-known good configuration to boot their system.
- **Console boot.** Provides minimal boot with command line access only.

Windows Update

Users can download system enhancements such as drivers, service packs and new functionality that has been specifically selected to work with their PCs from Windows Update. Customers access Windows Update through the Windows Update icon on the Windows 2000 Professional Start menu. With Windows Update, users can choose to scan their PCs to receive a list of downloads that are specific to their computer's hardware and software configuration.

Windows Update for Windows 2000 Professional extends this functionality to the enterprise space. For IT managers who want to closely control the types of updates users download to their machines, Windows Update offers a number of tools for managing this process, including:

- **Corporate IT Catalog**. Windows Update will provide a searchable catalog of

updates, drivers and more for corporate IT managers. The IT manager will be able to select which downloads are available to users, download them to a server behind a firewall, and make them available over the intranet.

- **Disabling Windows Update**. It is possible to remove the Windows Update icons that appear in the Start menu. Disabling the icons prevents users from accessing the Windows Update site (http://windowsupdate.microsoft.com) from anywhere within the Windows 2000 Professional product.

Management Console

Microsoft Management Console (MMC) is an extensible, common, remotable console framework for management applications. MMC does not supply any management behavior, but instead provides a common environment for Snap-Ins, written by Microsoft and ISVs. Because Snap-Ins are ActiveX® controls, administrators can create and combine virtually any type of tool, either for other administrators or for users. Many Windows 2000 Professional administrative tools are written as MMC snap-ins.

Scripting Host

The Microsoft Windows Scripting Host (WSH) is a language-independent scripting host for 32-bit Microsoft Windows operating system platforms. Microsoft provides the Visual Basic, Scripting Edition (VBScript) development system and Java Script scripting engines with the Windows Scripting Host. Microsoft anticipates that other software companies will provide Microsoft ActiveX® scripting engines for other languages such as Perl, TCL, REXX, and Python.

Scripts can be run directly from the desktop simply by clicking on a script file, or from the command console. Because WSH is language-independent, it is possible to use existing scripts, or to create scripts with functionality available in other languages, in the Windows 2000 Professional environment.

New Scripting Commands

To help administrators remotely manage systems, Windows 2000 Professional supports the ability to script more features from the command line or run command. Additional areas of scripting support include:

- Computer Management
- Printer Management
- Page File
- Service Management
- Network Configuration
- Device Management
- Process Management
- Thread Management
- Event log management
- User Management
- Security
- File system

- Application Management

System Instrumentation

Windows 2000 Professional supports system instrumentation based on the WBEM standard developed by the Desktop Management Task Force. The Windows 2000 Professional implementation, known as Windows Management Instrumentation (WMI), is a kernel-level instrumentation technology that provides a common way to report events. WMI is extensible, so hardware, applications, and OS components can be instrumented.[7]

WMI publishes information, configures device settings and supplies event notification from device drivers. WMI is part of the Win32 Driver Model (WDM) architecture; however, it has broad utility and can be used with other types of drivers as well (such as SCSI and NDIS). WMI distributes the following data:

- **Published data**. A standard set of WMI data will be built into port or class drivers supplied in Windows 2000 Professional.
- **Custom data**. Provided through OEM/IHV driver extensions.
- **Secure data**. Provided through Windows 2000 security descriptors for a designated usage.
- **Expensive data (optional***)*. Some data collection activity can significantly affect the performance of the driver; this data should only be collected when the management application specifically requests it. By default, a driver will not collect expensive data.
- **Event Notifications**. Event notification is a key feature of WMI, allowing drivers to detect hardware events or errors. An event can then be passed to WBEM for corrective action based on the specific event that occurred. For example, a disk driver that has an abnormally high amount of disk read/write errors sends an event notification to a disk-management utility.

WMI also allows a management application to configure a device. A management application may need to reconfigure a device based on a driver-raised event or the data collected by the management application.

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[7] Data for the System Information Snap-in comes from WMI.

ENHANCED DESKTOP MANAGEMENT

Windows 2000 Professional provides enhanced support for management software, including management capabilities available in Windows 2000 Server through the Active Directory. Support for standards such as WMI and WBEM ensure that a broader range of tools can be used to manage Windows 2000 Professional. In addition, Windows 2000 Server provides change and configuration management through the IntelliMirror management technologies.

IntelliMirror Management Technologies

IntelliMirror describes the set of capabilities that are possible when Windows 2000 Professional and Windows 2000 Server are used together. The following is an overview of IntelliMirror capabilities.

User Data Management

A Windows 2000 Professional environment can significantly increase the availability and protection for a predefined set of folders, documents, and data (set through Policy). For example:

- **Increased protection**. A user's important documents are protected because a *mirrored* copy is always kept on the client and on the server (and server-based copies are easier to back up). To maximize performance and minimize network traffic, both local and server copies are opened but edits are made to the local copy. As edits are made, Windows 2000 Professional uses a write-through cache to keep the server copy current.
- **Increased availability**. Users can access their data—even if the network goes down—by using the local mirrored copy. Changes can be automatically synchronized when the network comes back.
- **Data follows the user (roaming)**. Users can access their important documents from any Windows 2000 Professional-based PC on the corporate network by accessing the server mirrored copy. To maximize performance, users can have expanded choices on what information to download, if any. Any changes are automatically synchronized the next time the person signs on to their primary desktop computer. Windows 2000 Professional security prevents others from viewing that information.

Administrators have significantly easier, more flexible ways to manage user data. For example:

- **Easier server-based storage**. Any folder can be redirected to any server or combination of servers using Distributed File System (Dfs) technology. (By default, the My Documents folder is automatically set to be mirrored.) This makes it easy to group together critical data for easy backup. Changes to file storage locations are transparent to users. Disk quotas can be set on a per user/per volume setting to manage how much disk space is available for users.
- **Easier policy management**. Policy can be set for how and where users can access documents, such as a policy that users must always save documents to a specific folder (for example, My Documents). This policy will follow users to

any system.

Software Installation and Maintenance

In a Windows 2000-based environment, users experience improved application availability and reliability. For example:

- **Easier application installation and upgrading.** Using the Add/Remove Programs Wizard, users can view all of the available applications on the corporate network. Administrators make applications available as part of a user's profile.
- **Eliminate Unknown File Type messages.** When users open a file created in an application that is not installed on the machine, such as an e-mail attachment, the system can automatically go to the network distribution point to install the application. The system also checks to see whether the user has permissions to access the application before making it available. Depending on the application size, this procedure can be almost transparent to the user.
- **Applications follow the user**. Because applications are stored as part of a user's profile, users have easy access to their applications when signing on to another Windows 2000 Professional-based PC on the corporate network. To maximize performance and reduce network traffic, the application installs only when it is invoked—although it may appear as part of the Start menu.
- **Fewer application errors**. If critical components of an application change or become corrupted, launching that application will automatically begin a network search for replacement files.

A Windows 2000-based environment makes it significantly easier to manage applications from a centralized, remote location. For example:

- **Distributing applications using Policies.** Using the new Application Deployment Editor—an MMC snap-in that ships with Windows 2000 Server— administrators can set many different policies, including installing, upgrading, or removing applications, based on users, machines, groups of users, and groups of machines. Administrators can choose between assigning (mandatory) and publishing (available) applications to users. New policies take effect the next time a user logs on.

User Settings Management

The combination of Windows 2000 Professional and Windows 2000 Server can provide users with a familiar environment wherever they want to access information. Settings, such as Start menu items, key shortcuts, Web favorites, desktop settings (for example, wallpaper, fonts) and printer paths can follow a user whether they are offline or using another Windows 2000 Professional-based PC on the corporate network. Users can also set different preferences based on where they are accessing information.

For administrators, the combination of Windows 2000 Professional and Windows 2000 Server makes it easier to define specific computing environments for users

and computers without touching those desktops. In addition to managing software and user documents, administrators can use Group Policies to define a wide range of settings for individuals or groups of users and machines, including:

- **Desktop preferences**. Virtually anything related to the shell (graphical user interface), such as access to commands, network folders, and Intranet/Internet HTTP/FTP sites, Web shortcuts, desktop settings (for example, favorites, colors, wallpaper, fonts, and Start menu), Outlook mail store, printers, and more can be defined using Group Policies. Group Policies can also be used to set what follows the user, what the user can change, preferences that are specific to an application (for example, a company-wide spell checker), and scripts that run during log on, log off, start up, and shutdown.
- **Security settings**. Administrators can determine what users or computers can and can't access by setting Access Control Lists on files and directories.
- **Delegated administrative privileges**. Group Policies enable administrators to control who can set permissions on files and folders, publish items to the Active Directory, and create new groups.

Remote Windows Installation (for Machine Replacement)
When combined with IntelliMirror capabilities, Remote Windows Installation (see te section on Easier Setup and Deployment for a more detailed description) brings administrators closer to the ideal of a fully replaceable PC. This means that a user's desktop environment—including its operating system, applications, documents, and desktop settings—can be replicated with nothing more than a valid user password and hardware that supports this capability.

The combination of Remote Windows Installation and IntelliMirror will automatically restore elements defined through policies. For example, if an administrator sets a policy that users can install any application, only applications that have been set through that policy will be restored. In other words, disaster recovery works within the predefined, policy-set areas.

FOR MORE INFORMATION

For the latest information on Microsoft Windows® 2000 Professional, check out our World Wide Web site at http://www.microsoft.com/windows/professional.

For the latest information on the Windows 2000 Beta 3, check out the World Wide Web site at http://ntbeta.microsoft.com.